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Editorial

Ethnic food for longevity pursuit: assessment of Korean ethnic food

Historical pursuit for elixirs of life

The first official record in human history on the search for elixirs to overcome immortality can be found in Gilgamesh story of Mesopotamian Uruk, almost 5,000 years ago. The legendary story was written in clay plate with cuneiform letters, in which the hero, Gilgamesh, had a wish to save the life of his best friend, Enkidu. Therefore, he attempted to visit Utnapishtim, the wisest human in the underground land for information, who guided Gilgamesh to the bottom of the sea for a plant looking like a box-thorn, the Plant of Heartbeat (*sham-mu an-nu-u sham-mu ni-kit-ti*) for regaining the vigor of man. Although Gilgamesh succeeded in acquiring the plant, the elixir was finally stolen by a serpent. This story is not just the beginning of the elixir pursuit, but also implicates the futility of man's endeavor to overcome immortality [1]. Despite this disappointing Gilgamesh legend, hundreds of myths on elixirs of life for immortality pursuit around the world have been ensued. To illustrate: in Greek mythology, the divine foods for immortality were known as ambrosia and nectars; in Chinese mythology, peaches of immortality (仙桃, 蟠桃) were consumed by the immortals due to their mystic virtue of conferring longevity; in Indian mythology, *amrita* and *soma*, the elixirs of life, gave immortality to anybody even with the intake of a tiniest portion. Most of these mythic elixirs are of plant origin in forms of vegetables or fruits as juice, fermented drinks, mixture, or the fruit body itself. These legendary elixirs emphasized something edible, symbolizing the mystic value in special foods. After the mythic legendary times, however, entering into the mystery search period, the official historic record on longevity pursuing elixirs was forced to action by the first Chinese emperor Qin-shi-huang (秦始皇). Although not successful, the official and systematic human trials to acquire the elixirs of life initiated a new era of longevity pursuit. However, the failure of reckless geographic expeditions for elixirs in legendary places prompted to develop in substitution the technology of alchemy for artificial preparation of elixirs in China and Arabia, which later continued to Christian society until the 17th century. In this period, the imaginary fountain of youth, holy grails, and philosopher's stone or special pills composed of jade, cinnabar, or hematite have been pursued, albeit in vain. With the coming of the mechanism-based logic period, the concept of and enthusiasm for immortality pursuits have been criticized on the scientific bases for safety and efficacy. In consequence, the ancient mysterious and even frauds on human mortality extension have been drastically overturned due to their futility and toxicity.

Current trend of longevity pursuing diets

Among many tools and techniques for longevity extension, the current trend in food and dietary pattern for human mortality extension shall be briefly described in this commentary. So many varying fad diets for human longevity pursuit come and go, like ebb and tide, such as low-carb diet, low-calorie diet, high-protein diet, low-fat diet, balanced diet, and Atkins diet. However, it might be appropriate at this time to concentrate our discussion only on the ethnic or ethnic-like diets, which are not specifically focused to some diseases or special condition effects but rather targeting the general heath improvements for longevity. In this aspect, it is obvious at present that the major trend of food and diet for health and longevity is rather overwhelmed by the restriction of principle of foods in response to the astonishingly high increase in diseases of affluence in this modern world.

The most popular dietary pattern for longevity is calorie restriction (CR), which has been proposed by many disciplines. However, the first influential suggestion was by Alvise Cornaro in his books about the secrets to living long and well with measure and sobriety [2]. His book *Discorsi della vita sobria* (1583–1595), describing his regimen of CR, was extremely successful, and influenced the community strongly to change the concept of aging by rejecting conventional wisdom that old age was a period of misery and decay. Since his books on CR and sober life, many of the celebrated people followed his regimen, representatively including Benjamin Franklin. Not only in Western society, but also in the East, CR has been acknowledged as one of the best ways to live long by many of the religions including Buddhism, Taoism, and Hinduism. Taoists in particular regard diet as extremely important to physical, mental, and spiritual health, especially where the amount of *qi* (氣) in the food is concerned. Some Taoist diets called for *bigu* (辟谷, 辟穀 *avoiding grains*) on the belief that immortality could be achieved in this way. Taoist often encourage practitioners to be vegan to minimize harm [3]. Taoist tradition of avoiding grains has been influenced strongly by the oriental culture. Recently, with scientific research and development programs, the value of CR has been accentuated and evidenced in depth and width with a variety of protocols using many different animal models.

Furthermore, the tremendous increase in diseases of affluence in modern civilization has led people to believe that after the dawn of agriculture those diseases were caused by changes in diet. Thereby, the Paleolithic (paleo) diet (caveman diet or stone-age diet) has been naturally proposed to be a substitute diet to the modern enriched diet, based mainly on foods presumed to be

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available to Paleolithic humans, including vegetables, fruits, nuts, roots, meat, and offal, excluding foods such as dairy products, grains, sugar, legumes, processed oils, salt, and alcohol or coffee. The paleo diet, recommending fewer processed foods and less sugar and salt, is consistent with the present mainstream advice about diet in general. Theory-wise, the evolutionary discordance hypothesis indicates that many chronic diseases and degenerative conditions evident in modern Western populations have arisen because of a mismatch between stone age genes and recently adopted lifestyles. Advocates of the paleo diet argue that modern people should follow a diet that is nutritionally closer to that of their Paleolithic ancestors [4].

A macrobiotic diet has been suggested as a diet to balance the yin and yang elements of food; this means that grains are a staple, supplemented with other foods such as vegetables and soy and certain kinds of cookware should be avoided. Hufeland, a German physician, who coined the word macrobiotics in the context of food and health, considered macrobiotics a science aimed at prolonging and perfecting life as a medical philosophy on a higher level than the curative, preventative, or health levels of medicine. The macrobiotic approach mainly focuses in choosing the processed food. A macrobiotic diet includes many of the same foods as vegetarian diets, but in macrobiotics some types of fish and other animal products are often included according to individual needs, although the diet avoids milk and other dairy products [5].

These patterns of diet, mainly based on restriction principle, have influenced persuasively the civilized people and requested them to adopt the principle as one of the behavioral correction strategies for longevity. However, the practical inconvenience and difficulty in pursuing restricted diets in daily life limited their application. Nevertheless, criticism of CR for its limited effects only on caged animals but not on free open field-living organisms has reduced the value of CR recently. And criticisms by nutritionists of the paleo diet and macrobiotic diet for their limits in nutritional balance with some side effects also detain their wide application.

Conflict of the *to eat or not to eat* principle in longevity pursuit

For the pursuit of longevity or immortality, it was required to eat something good as ambrosia-like, nectar-like, or *amrita*-like in the ancient period. Thereby, many legendary searches for elixirs were rushed. In the meantime, the revolutionary concept of restriction principle was born and started to prevail overwhelmingly up to now. This dichotomy of to eat or not to eat has confused and frustrated those who look for food of health and longevity. In steps with these trends, food scientists are apt to recommend specific foods with quantity for health maintenance and disease prevention, while many of nutritionists are prone to restrict the foods and to emphasize balance rather than quantity. This issue reminds us of the conflict of quality versus quantity in longstanding philosophic debates. Thereby, it was natural that the concept of optimization of foods was proposed by Buttriss [6], who defined the optimal diet as the diet that maximizes both health and longevity through preventing nutritional deficiencies as well as reducing risks of diet-related chronic diseases by balancing intakes of nutrients.

Nonetheless, the current trend of food engineering industries is practically targeting several major goals for healthy food products. To summarize them, glycemic index, low fat to right fat, heart health, wellbeing (digestive support, detoxification, enhancement of mental wellbeing, energy, immune system, and skin health), individualization (personalized, daily dosing, age appropriate), and functional foods (chemoprevention, prevention of allergy, osteoporosis, and menopausal syndrome) are mainly concerned with food production and to encourage their consumption with publicizing health promotion. Consequently, the tremendous amount of the industrial food propaganda for health pursuit leaves people feeling dizzy and entangled.

New definition of longevity food, based on ethnic food

Despite varying foods being listed as longevity foods, the criticisms have never ended, with issues on lack of scientific basis, practical difficulty, and emerging side effects. Therefore, it is time to define longevity food in more practical and tangible terms. For this purpose, I would like to propose a new definition of longevity food: traditional ethnic food in long-live zones with scientific evidence for health. The reason for the special emphasis on long-live zones is that the life style and dietary behavior of the relatively higher portion of people who live long in the specific zones can ensure more definitely and acceptably the efficacy of their own ethnic foods on health and longevity through their longstanding experiences and human records of mortality than any other theoretical or conceptual fad diets for health and longevity. In order to complete the proposal, several questions might be asked in parallel. Is the nature of the traditional ethnic foods in long-live zone different from other ordinary area? Are the lifelong dietary habits of long-lived people different from ordinary people? Is there the scientific evidence of the ethnic foods or dietary behaviors for their contribution to longevity?

Based on these questions, several key discoveries in the field of longevity foods can be readily figured out and illustrated. The first case is the Mediterranean ethnic diet, which concept was first publicized to reflect the food patterns typical of Greece and southern Italy by the Americans Ancel and Margaret Keys [7]. After accumulation of epidemiological data, originating mainly from the Seven Countries Study, the diet has profoundly influenced the nutrition society and its related medical and industrial field [8,9]. The principal aspect of this diet includes proportionally high consumption of olive oil, legumes, unrefined cereals, fruits, and vegetables, moderate to high consumption of fish, moderate consumption of dairy products (mostly as cheese and yogurt), moderate wine consumption, and low consumption of nonfish meat and nonfish meat products. The tantalizing impact of Mediterranean diet is derived from what is considered a paradox from the point of view of mainstream nutrition: regardless of relative high consumption of fat, the people living in Mediterranean countries have far lower rates of cardiovascular diseases than in countries such as the USA, thereby named the Mediterranean Paradox. A parallel phenomenon by wine consumption is known as the French Paradox. If not supported by epidemiological data for the ethnic foods of the Mediterranean area of high longevity, the efficacy of the diet would not have been readily accepted.

The second case is the discovery of the Inuit's secret of their ethnic diet. Dyerberg, a Danish doctor, discovered haphazardly the peculiar pattern of diseases and dietary habit of the Inuit in Greenland. He observed that coronary heart disease in Eskimos is a rarity, which led him to pay special attention on their food consumption: high protein, low carbohydrate, high fat diet essentially of mammalian marine origin. Compared with Danish food, the fatty acid pattern of the consumed lipids showed a higher content of long chain polyunsaturated fatty acids (especially C20:5) and lower contents of linoleic and linolenic acids. Describing the serum cholesterol level as a function of the nutritional fatty acids, the essentially lower serum cholesterol level found in Greenland Eskimos was not explained by conventional logic; therefore, he proposed a special metabolic effect of the long chain polyunsaturated fatty acids from marine mammals. And this discovery has opened a new field of omega 3/6 fatty acids for cardiovascular disease control and other health effects [10–12]. The

contrast between Mediterranean diet and Inuit diet is the emphasis on different fatty acids, respectively: monounsaturated fatty acids especially of oleic acid in Mediterranean diet, and polyunsaturated fatty acids in Inuit ethnic food. Discovery of this positive effect of the unsaturated fatty acids toward health opened and facilitated a new world of food industries and human nutrition.

The third case is the Okinawa ethnic diet. People from the Ryukyu Islands had the highest life expectancy in the world. The traditional diet of the islanders contains 30% green and yellow vegetables, with small quantities of rice (instead the staple is the purple-fleshed Okinawan sweet potato) and a tiny amount of fish and more in the way of soy and other legumes. Specifically, pork is highly valued with a unique cooking process only through steaming or boiling, never sizzling or roasting in Okinawa. The islanders are noted for their low mortality from cardiovascular disease and certain types of cancers, compared by age-adjusted mortality of Okinawans versus Americans, illustrating that an average Okinawan was eight times less likely to die from coronary heart disease, seven times less likely to die from prostate cancer, and 6.5 times less likely to die from breast cancer than an average American of the same age. In summary, the Okinawa ethnic food informs the value of food of plant origin, cooking process, and calorie restriction [13,14].

Korean ethnic food as the food for longevity

Through a survey of Korean centenarians on variety of life behaviors and dietary patterns, the uniqueness of Korean ethnic food can be unveiled. The initial main questions on the Korean ethnic foods to be assessed as longevity foods were as follows. What are the special factors for the difference in traditional foods between long-live zones and ordinary areas? What are the temporal factors for the difference in lifelong dietary behavior between long-live zone and ordinary area? What can be the scientific evidences for contribution of those foods or dietary behaviors to longevity? In order to answer those questions, several domains of food and dietary pattern of Korean centenarians and the long-live zone have been assessed.

The first domain of food materials

Meals of centenarians were comprised primarily of plant foods such as cereals, legumes and their products, vegetables, fruits, and so on. The average intake of cereals was mostly derived from rice as a staple food. They consumed vegetables with a large portion of vegetable intake in forms of various blanched vegetables (*namul*) [15]. They also consumed soybean-fermented foods in types of *doenjang* (*miso* equivalent), *chungkukjang* (*natto* equivalent), *gochujang* (pepper paste), or *kanjang* (soy bean sauce) [16]. Fruit intake was very low, compared to vegetable intake. They consumed animal foods, including meat, poultry, and eggs; fish and shellfish; and dairy products in limited amount. When assessed by the criteria for a well-balanced diet, which specify dietary diversity score > 3.0 and dietary variety score > 18.0, 91.9% of these individuals scored above 3.0 in the dietary diversity score and 48.7% scored above 18.0 in the dietary variety score [17,18]. These data indicate that the traditional foods those centenarians consumed are enriched with a variety of food materials with good balance and a spectrum of functional capacities such as antimutagenic, antioxidative, anticarcinogenic, lipid lowering, peroxide scavenging, and immune enhancing potentials [19–23]. Although the consumption of fruits was lower than expected, those fruit functions can be compensated by higher vegetable consumption. Therefore, it can be summarized that the combination of a variety of food materials with multiple health protecting effects in Korean ethnic food can contribute to improve the health condition of the people who consume them.

The second domain of cooking process

When the cooking process of the Korean ethnic food was analyzed, several unique pattern could be observed. The first is the blanching of vegetables for eating rather than fresh state. The blanching can reduce the nitrate content of the vegetables and can eliminate the toxic contaminants effectively. Furthermore, through blanching, the vegetables shrink, which facilitates their consumption, leading to higher uptake of fibers. The second point is the boiling of meats. Both beef and pork were mainly boiled or steamed for service rather than roasted or sizzled. This cooking process of meat would reduce fat content, facilitate detoxification and prevent the formation of mutagens, since formation of meat pyrolizates can be blocked [24,25]. The other Korean favorite cooking process is pan-frying. This pan-frying process for vegetables, fishes, meat with sesame oil can increase the edibility, detoxify, and prevent the formation of mutagens. Furthermore, the traditional style of combination of vegetables and meat together to eat would be healthy and safe, because this combination may contribute to suppress the activation of mutagens during digestion [26]. Therefore, it can be suggested that the Korean traditional methods for cooking by blanching, boiling, and panfrying would be the most effective cooking methods to prevent the formation of mutagens during cooking process, which would surely contribute to the reduction of the most devastating cancers and other degenerative diseases.

The third domain of nutritional compensation by fermentation

When Korean ethnic foods were analyzed, the dominant consumption of plant origin food raised a warning on the possible nutritional deficiency of vitamin B_{12}, which is mainly derived from animal food or dairy products. However, the prevalence of vitamin B_{12} deficiency in Korean centenarians was not higher when compared to cohorts in Western nations. It was a big mystery that Korean centenarians are nutritionally intact for vitamin B_{12} deficiency despite their vegetable-oriented dietary habits. And it was observed that Korean centenarians have consumed soybean-fermented foods such as *doenjang*, *chungkukjang*, *gochujang*, and fermented vegetables such as *kimchi* daily as well as seaweeds very frequently throughout their lives, which were eventually proven to be good resources for vitamin B_{12} by my group [27–29]. Since these are consumed widely on a year-round basis, these foods instead of animal origin could provide vitamin B_{12} to Koreans for generations. Therefore, it can be proposed that the Korean traditional ethnic foods can compensate the nutritional shortage of vegetable foods by fermentation process, which would overcome the unbalanced food composition for health of the long-lived people.

The fourth domain of restriction versus optimum

Male centenarians consumed 85.9% of the estimated energy requirement (EER) for men aged $\geq$ 75 years, 2,000 kcal/d, and female centenarians consumed 77.9% of EER for women aged $\geq$ 75 years, 1,600 kcal/d. The observed percentage of EER for energy intake in both Korean male and female centenarians was much higher when compared to the 60% found in a study of Okinawan centenarians. Related with that higher energy intake, male centenarians consumed more protein and carbohydrate than female centenarians, however, fat intake in men and women females was not different [17]. From these data, it can be summarized that the

traditional dietary pattern of Korean centenarians indicates the optimum consumption of calorie rather than restriction, which would ensure the physically active life style of long-lived people.

The fifth extra domain of beyond-food conditions

It is obviously beyond debate that the food factor would not be solely responsible for human longevity. As I proposed previously in Park's Temple Model of Longevity, natural, social, and behavioral variables would cooperatively and collectively contribute to longevity [30]. Food factor is only one of the behavioral variables, which include nutrition, exercise, relationship, and participation, but it is out of question that food factor is one of the most appealing conditions for human longevity. Furthermore, gene to food and food to environment interactions should be taken into consideration for in depth analysis, which implies that the human longevity should be understood in collective terms of space and time of living [16,17,30]. Therefore, the significance of the ethnic food with long history of practical application and scientific evidences cannot be exaggerated for the further application to and expansion of longevity food study.

Conclusion

Ethnic foods suffice the basic spatial and temporal conditions for human longevity food and guarantee the longstanding safety and efficacy of the people by those who have consumed and lived on. Many ethnic foods have been suggested to be effective and good for health and longevity, from which much scientific evidence for health has emerged. In extension, Korean ethnic food can be evaluated for its possibility to be one of the longevity foods. To summarize, the essence of Korean ethnic food can be characterized with the balance of nutrients, based on combination of diversified food resources, the nutritional compensation by fermentation, and the safest way of cooking for minimizing toxic materials and preventing hazard formation. Taken together, it would be reasonable and timely to conclude that the Korean ethnic food can be included in the list of longevity foods based on its healthy and scientific nature with longstanding experience.

Conflicts of interest

The author has no conflicts of interest to declare.

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